Opponents argue that the research is immoral as the cells are taken from viable human embryos. President Bush has suspended federal funding of such work and has announced a review of its future. He was urged this week by the Pope to outlaw the practice.

John Gearhart and Douglas Kerr, who led the privately funded research, hope that the tape will have a decisive impact on the debate by showing the potential of the technique. It shows mice paralyzed by motor neuron disease once again able to move their limbs, bear their own weight and even more around after injections of human embryonic stem cells in their spinal cords.

Dr. Kerr said that the team hopes to start human clinical trials within three years but that a federal funding ban would deal a ''potentially fatal blow'' to its efforts.

Details of its research were first revealed in November last year, though it has yet to be published in a peerreviewed journal. In this case, however, the team took the decision to show the tape to Tommy Thompson, the U.S. Health and Human Services Secretary, who is conducting a review of stem cell funding for President Bush, and to Pete Domenici, a Republican senator. It is now to be released to the public as well.

Medical research charities said the video would have a major impact. ''I wish the President would see this tape,'' said Michael Manganiello, vice-president of the Christopher Reeve Paralysis Foundation, named after the Superman actor who was paralyzed in a riding accident.

''When you see a rat going from dragging his hind legs to walking, it's not that big a leap to look at Christopher Reeve, and think how this might help him,'' he said.

In the experiment, 120 mice and rats were infected with a virus that caused spinal damage similar to that from motor neuron disease, the debilitating condition that affects Professor Stephen Hawking. The disease is generally incurable and sufferers usually die from it within two to six years.

When fluid containing human embryonic stem cells was infused into the spinal fluid of the paralyzed rodents, every one of the animals regained at least some movement. In previous tests stem cells have been transplanted directly into the spinal cord. Infusing the fluid if far less invasive and would make eventual treatment in humans much easier.

Dr. Kerr said the limited movement seen was a reflection of the limited research, not of the limits to stem cells themselves.

''I would be a fool to say that the ceiling we have now is the same ceiling we'll see in two years,'' he said. ''We will be smarter and the stem cell research even more developed.''

However, the prospect of human trials in three years depends on the outcome of a political and ethical debate over whether the US Government will allow federal funding for stem cell research. If President Bush decides not to approve government funds for research, that would set the timetable back 10 to 12 years for tests in humans, Dr. Kerr said.

The controversy stems from the fact that human embryos must be destroyed in order to retrieve the stem cells. Mr. Bush is under pressure from conservative Republicans and Roman Catholics not to back the research on moral grounds.

Some top American scientists, who are becoming increasingly frustrated with the funding limitations, have left for Britain where government funding is available. The British Government has approved stem cell research on the ground that it could help to cure intractable disease.

The research on rodents at Johns Hopkins took stem cells from five to nine-week-old human fetuses that had been electively aborted.

THERAPIES

There is no cure for ALS, and more research needs to be done in order for there to be one.

Currently, there is only one drug on the market that has been approved by the FDA for the treatment of ALS: Riluzole. It was originally developed as an anti-convulsant, but it has also been shown to have anti-glutamate effects. In a French trial, it was found that those taking the drug had an enhanced survival rate of 74% as compared to only 58% in the placebo group. [1] But, the drug has gotten mixed reviews, with divergent results occurring throughout the trials.

Creatine has also been shown to help motor neurons produce needed energy for longer survival and is currently being tested in clinical ALS trials. Creatine is an over-the-counter supplement that is popular as a muscle builder among athletes. Creatine is a natural body substance involved in the transport of energy. Studies using SOD1 mice found that animals given a diet high in creatine had the same amount of healthy muscle-controlling nerve cells as mice in the normal, or control, group. Creatine can be found in a variety of health food stores.

Sanofi, still in clinical trial, is a nonpeptide compound which possesses neurotrophin-like activity at nanomolar concentrations in vitro, and after administration of low oral doses in vivo. The compound reduces the histological, neurochemical and functional deficits produced in widely divergent models of experimental neurodegeneration. The ability of sanofi to increase the innervation of human muscle by spinal cord explants and to prolong the survival of mice suffering from progressive motor neuronopathy suggest the compound might be an effective therapy for the treatment of ALS.

The mechanism by which sanofi elicits its neurotrophic and neuroprotective effects, although not fully elucidated, is probably related to the compound's ability to mimic the activity of, or stimulate the biosynthesis of, a number of endogenous neurotrophins such as nerve growth factor (NGF) and brain-derived, neurotrophic factor (BDNF). While sanofi has high affinity for serotonin 5-HT1A receptors and some affinity for sigma sites, its affinity for these targets appears to be unrelated to its neurotrophic or neuroprotective activity.

STEM CELL THERAPY

Therapeutic efforts are underway to prevent diseases or prevent their progress, but more is going to be needed in order to repair the damage that has been done in ALS. Neurons are dead and muscles have atrophied; these must be regenerated to get back what has been lost. Stem cell therapy is going to be key.

The definition of a stem cell is under debate, but most researchers agree with the properties of multipotency, high proliferative potential and self-renewal.[2]

Embryonic and fetal stem cells differ in their isolation periods, and thus their potentials. Embryonic stem cells are derived very early in development, either at or before the blastocyst stage, and are defined as pluripotent, with the ability to differentiate into multiple cell types. When a sperm fertilizes an egg, that cell will then go on to further divide and differentiate into cells that will make up the entire body. If cells are captured before they differentiate, those cells then have the ability to become many types of desired cells. Fetal stem cells, which can be isolated at a later stage (from aborted fetuses, for example), are more differentiated and thus more restricted in the lineage they can become. Research has shown that the beauty of the embryonic stem cell is in its ability to become all types of cells, migrate, and respond to cues in the transplanted environment.

Adult stem cells can be isolated from certain areas in the adult body, including neurogenic areas of the brain (the dentate gyrus and olfactory bulb), and bone marrow. Recent research has shown bone marrow derived stem cells are very versatile, differentiating into muscle blood, and neural cell fates. [3] While adult stem cells hold promising hope, they are not abundant, are difficult to isolate and propagate, and may decline with increasing age. Some evidence suggests that they may not have the differential potential and migratory ability as embryonic stem cells. Also, there is concern that adult stem cells may harbor more DNA mutations, since free radical damage and declination of DNA repair systems are known to occur more with age. [4] Any attempt to treat patients with their own stem cells, which from an immunologic standpoint would be great, would require those stem cells to be isolated and grown in culture to promote sufficient numbers. For many patients, including ALS patients, there may not be enough time to do this. For other diseases, such as those caused by genetic defects, it might not be wise to use one's own cells since that genetic defect is likely to be in those cells as well. Adult stem cells are less controversial, due to no isolation from embryonic or fetal tissue, but they may not have the same therapeutic potential.

Dr. Evan Snyder and his lab at the Boston Children's Hospital have transplanted embryonic mouse stem cells (C17.2) into the spinal cords of onset SODI mice. These cells were found to integrate into the system, with some found to have differentiated into immature neurons. Rotorod analysis, which measures functional behavior, indicated that those animals that had received a transplant, had improved fucntional recovery as compared to those that had not received cells. (This data is in press and will be presented at the Neuroscience Conference in San Diego, Fall 2001.)

Dr. Snyder and his team are also involved in embryonic stem cell transplant in primate models that resemble ALS. This is exciting work that may help push stem cell therapy to clincal trial. This research is being funded by Project A.L.S. (go to www.projectals.org)

Recently, it was reported that researchers at Johns Hopkins had made an exciting finding with stem cell therapy in regards to ALS. The following report is taken directly from the Johns Hopkins press.

STEM CELLS GRAFT IN SPINAL CORD, RESTORE MOVEMENT IN PARALYZED MICE

Scientists at Johns Hopkins report they've restored movement to newly paralyzed rodents by injecting stem cells into the animals' spinal fluid. Results of their study were presented in the annual meeting of The Society of Neuroscience in New Orleans.

The researchers introduced neural stem cells into the spinal fluid of mice and rats paralyzed by an animal virus that specifically attacks motor neurons. Normally, animals infected with Sindbis virus permanently lose the ability to move their limbs, as neurons leading from the spinal cord to muscles deteriorate. They drag legs and feet behind them.

Fifty percent of the stem-cell treated rodents, however, recovered the ability to place the soles of one or both of their hind feet on the ground. ''This research may lead most immediately to improved treatments for patients with paralyzing motor neuron disease, such as amyotrophic lateral sclerosis (ALS) and another disorder, spinal